Elkhorn Coral *(Acropora Palmata)*

Elkhorn coral is one of the most important corals in the Gulf wide reef ecosystem. Along with other coral species they built coral reefs in the region over last 5000 years. Elkhorn coral can form dense groups called "thickets" in very shallow water. These provide important habitat for other reef animals, especially fish.

Elkhorn coral is found typically in clear, shallow water (1 to 15 feet) on coral reefs throughout the Bahamas, Florida, and the Caribbean. Elkhorn coral lives in high-energy zones, with a lot of wave action. However, high wave action that occurs during major storms can cause this species of branching coral to break.

Elkhorn coral have both male and female reproductive organs, they release eggs and sperm into the water column once a year, generally a few days after a full moon in July/August. Baby corals (larvae) remain floating in the water about 5 to 20 days before they settle on substrates. Most elkhorn larvae prefer to settle on red algae. Coralline (red) algae is thought to serve as a settlement indicator that aids in survival. Once coral larvae settle they are refferred as "spat". Elkhorn coral prefer to settle on upward facing sides of substrate.

Due to their tree-like growth formation, elkhorn corals provide complex habitat for fish and other coral reef organisms. When elkhorn corals are abundant, they provide shoreline protections from large waves and storms.

The greatest threat to elkhorn coral is ocean warming, which cause the corals to become strssed and release the symbiotic algae called zooxanthellae. This symbiotic algae lives in the tissue of coral and provides them food via photosynthesis. If corals becomes stressed for too long they can expel a high volume of this algae making them more susceptible that usually results in death. High water temperatures and rapid changes in water temperatures increase elkhorn corals susceptibility to diseases.

Changes in ocean pH may slow growth in elkhorn coral and growth rates have slowed since the 1970's. Elevated carbon dioxide levels also affect reproduction and settlement of larvae.

Learn more about these and other coral species in the Gulf of Mexico on our coral web portal at https://portal.gulfcouncil.org

GULF OF MEXICO Fishery Management Council

NOAA CORAL REEF

Staghorn Coral *(Acropora cervicornis)*

Staghorn coral is one of the three most important corals in the Gulf region in terms of contribution to reef growth and fishery habitat. Staghorn coral is a branching coral typically found in clear, shallow water (15 to 60 feet) on coral reefs throughout the Bahamas, Florida, and the Caribbean. Staghorn coral lives in many coral reef habitats including spur and groove, bank reef, patch reef, and transitional reef habitats, as well as on limestone ridges, terraces, and hard bottom habitats.

Staghorn coral is one of the fastest growing corals - when healthy, it can grow up to 8 inches in branch length per year. Staghorn coral can reproduce sexually by broadcasting sperm and egg in water column but also reproduces successfully by fragmentation. Fragmentation occurs when pieces of the coral are broken off, a new coral colony can grow from the broken piece (like a plant grafting). This is advantageous for surviving the extreme storm events that sometimes occur in this region. Because of this, staghorn coral is an excellent candidate species for coral nursery programs.

Between 1970s and early 2000s, the staghorn coral population declined 97% from white band disease in locations throughout Florida, Jamaica, U.S. Virgin Islands, and Belize. White band disease kills the coral's tissues. This disease is transmitted by a coral-eating snail and via contact with elkhorn coral. Remaining populations consist mostly of isolated colonies or small groups of colonies compared to the vast thickets once prominent throughout its range. Due to the limited gene exchange (genetic diversity) of sperm and egg, successful reproduction is rare, so it is difficult for staghorn coral populations to reach previous population abundance.

Climate change is a primary threat to staghorn coral. Increasing ocean temperatures leading to an increased prevalence of the disease such as white band disease. White band disease is transmitted by a coral-eating snail and via contact with elkhorn coral.

Changes in ocean acidity can affect growth rates and levels of calcification. Ocean acidity has not been documented to slow staghorn coral growth rates, but a decrease in calcification was observed. Decreased calcification due to increased carbon dioxide levels which has been increasing since 1800's and is projected to increase by the end of the century could increase their susceptibility to storm damage.

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GULF OF MEXICO Fishery Management Council

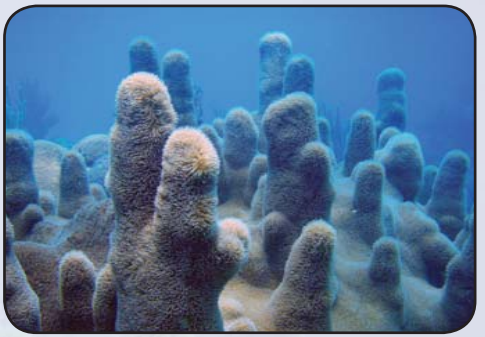
NOAA CORAL REEF

Pillar Coral *(Dendrogyra cylindrus)*

Pillar coral is a hard coral found in the western Atlantic Ocean and the Caribbean Sea, though absent from the southwest Gulf of Mexico. Pillar Coral gets its name from the tall, pillar-like columns that the coral colonies build over decades on flat or gently sloping sea floors. Pillar coral inhabits most reef environments in water depths ranging from approximately 3 to 75 feet, but it is most common in water between approximately 15 to 45 feet deep. When undisturbed, the cylindrical columns can reach impressive heights of up to ten feet. It often resembles fingers or a cluster of cigars, growing up from the sea floor.

Pillar coral is a slow-growing, long-lived species. It is one of the few hard coral species that has its polyps extended out for feeding during the day (most hard corals feed at night), which is why many people think pillar coral is covered with hair.

Unlike elkhorn corals that have both male and female reproductive organs in one colony, the pillar coral are either male or female, meaning they can release either sperm or egg for reproduction. Pillar coral colonies release eggs or sperm into the water column once a year, usually between August and September for two to five nights after a full moon. The larvae are planktonic and drift with the currents before settling on the benthic substrate. Pillar corals can also reproduce by fragmentation like staghorn corals. Pillar corals have a unique formation, as a number of columns vertically grow up from a basal plate. If the whole colony is dislodged and topples over, new cylindrical pillars can grow vertically from the fallen (fragmented) coral. Some specimens have been found where this has happened more than once, and the age of the colony can be deduced from its shape.



Increased ocean temperature contributes to disease in pillar corals. On the Florida Reef Tract, black band disease has been reported in pillar coral when temperatures exceed 29°C. In 2014, 4.7% of surveyed pillar corals had been impacted by black band disease and in 2015 that number increased to 6.8%. In each case, the disease appeared immediately following an event of increased water temperatures.

Pillar corals have numerous threats as they have a low rate of juvenile survivorship, meaning that it is slow to recover from disturbances, such as fisheries, human development, pollution, and invasive species, placing its future survival at even greater risk.

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GULF OF MEXICO Fishery Management Council

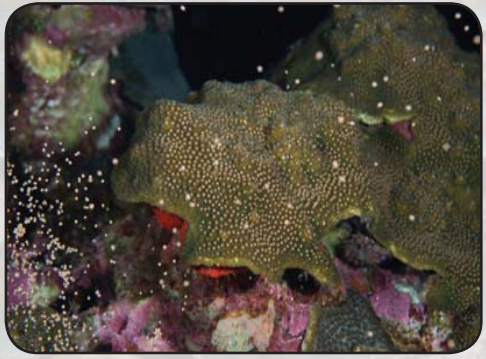
NOAA CORAL REEF CONSERVATION PROGRAM

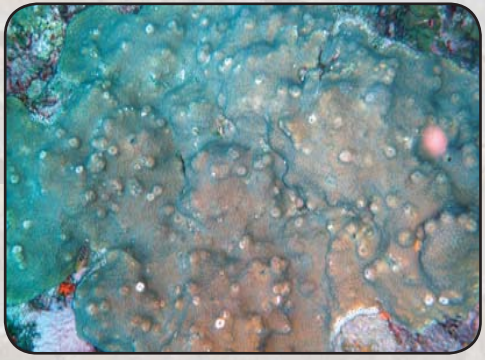
Boulder Star Coral *(Orbicella franksi)*

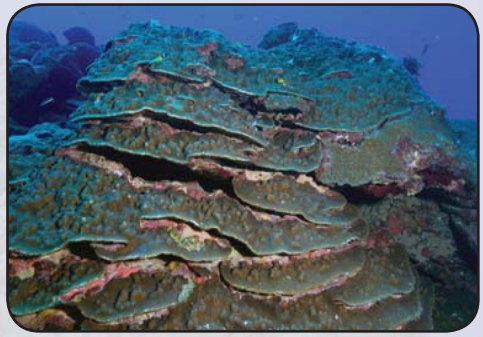
Boulder star corals look much like other stony coral species. The biggest difference with this coral is the corallite structure, are distinguished by large, unevenly arrayed polyps that give the colony its characteristic irregular surface. They are usually orange-brown, greenish-brown or greyish-brown, but the extremities of the lumps are often pale or white. Colony form is variable, and the skeleton is dense with poorly developed annual bands. Colony diameter can extend up to 17 feet with a height of up to 6 feet. Boulder star coral occurs in the western Atlantic and throughout the Caribbean, including the Bahamas, Flower Garden Banks, and the entire Caribbean coastline.

Boulder star coral is reported to be the slowest growing of the three species in the stony coral family (lobed and mountainous star coral). They grow slowest in deep or murky waters. Boulder star coral have both male and female reproductive organs that release eggs and sperm into the water column one to two times per year. Growth rates for boulder star coral are slower than those of lobed star coral. Their larvae are capable of surviving greater than 20 days, which may allow them to disperse long distance and settle into large geographic areas. This suggests the depth where spawning occurred did not impact the depth of settlement.

Boulder star coral tends to have a deeper distribution than lobed or mountainous star coral. It occupies most reef environments and has been reported from water depths ranging from approximately 15 to 160 feet, with the complex reported to 300 feet. They are a common, often dominant, component of Caribbean mesophotic reefs, defined as greater than > 100 feet. This suggest the potential for deep refugia for boulder star coral, to survive in changing environmental conditions.







Increases in ocean temperature cause bleaching in boulder star coral. Unlike other similar species in its complex (mountainous and lobed star coral), spawning timing was not impacted by these bleaching events. Though, bleached colonies were documented to be 50% less likely to spawn than unbleached colonies. They are also susceptible to coral plague, yellow-band disease, and black band disease

Several population projections indicate population decline in the future is likely at specific sites and local extinction could occur within 25 to 50 years if poor conditions such as high mortality, low recruitment, and slow growth rates persist.

Learn more about these and other coral species in the Gulf of Mexico on our coral web portal at https://portal.gulfcouncil.org

GULF OF MEXICO Fishery Management Council

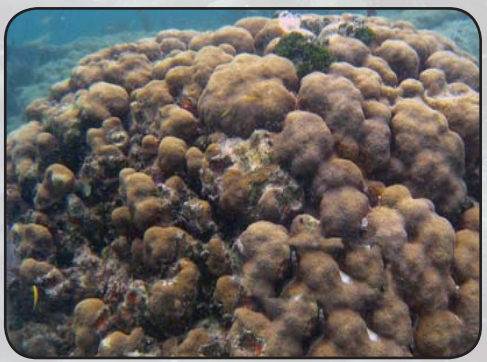
NOAA CORAL REEF

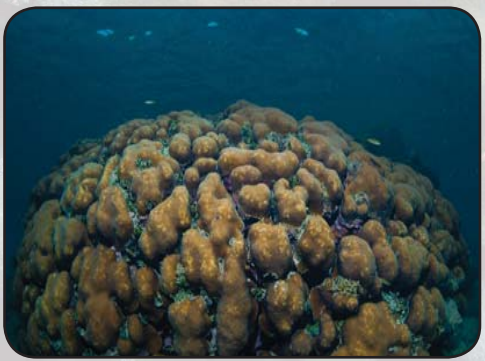
Lobed Star Coral *(Orbicella annularis)*

Lobed star coral is the most abundant species of reef-building coral with the largest average colony size of any coral species. It is widely distributed throughout the Caribbean including the Bahamas, Florida, and the Gulf of Mexico. Lobed star coral has varying colony shapes such as heads, columns and plates primarily due to the response to differing light conditions.

Several morphological variations occur which depend on water depth, water currents, lighting and mineral concentrations. Colonies known to exist as domes, columns or flat shelf-like structures; however colonies are generally branching or lobed. Colonies also show variations in color of the polyps (symbiotic algae), including shades of green to brown, yellow-brown and grey. Colonies thrive in marine waters ranging from 2-270 feet, but more abundant in reef environments from 3-33 feet deep. Sometimes they are found in lagoons and upper reef slopes. This species cannot grow in opaque waters because, as like all corals, light is required for the photosynthesis of the symbiotic algae. Additionally, the lobed star corals obtains nutrition when the polyps catch prey, mostly zooplankton.

Coral reefs and star coral colonies form a barrier in the ocean that absorbs energy from storm waves, thus preventing coastal erosion. Due to the massive size of their presence in coral reefs around the Caribbean islands, they aids in shoreline protection of these islands. They provide spawning grounds for large numbers of fish and other aquatic organisms. This species therefore plays a pivotal role in maintaining the biodiversity in Caribbean waters.





Major threats to lobed star coral include infectious diseases such as the yellow band and black band disease, bleaching, predation by parrotfish, hurricanes, algal overgrowth and sedimentation. Human threats include local fisheries, recreational and tourism activities and pollution.

Temperature greatly affects this species, as a bleaching event in Puerto Rico in 2005 impacted more than 90% of colonies surveyed where white plague and yellow band disease have resulted in declines that have persisted in populations long-term.

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GULF OF MEXICO Fishery Management Council

NOAA CORAL REEF

Mountainous Star Coral *(Orbicella faveolata)*

Mountainous star coral (also known as reef building coral) is native to the Caribbean Sea and the Gulf of Mexico. They are most abundant on the front reef slopes between the depths of 33 to 66 feet. Its color is usually pale brown but may be deep brown with fluorescent green highlights.

Mountainous star coral grows in heads or sheets, the surface of which may be smooth or have keels or bumps. The skeleton is much less dense than in the other two star coral species. Colony diameters can exceed up to 30 feet with heights of 13 to 16 feet. Mountainous star coral is a slow-growing species and the rate at which new colonies are formed is less than the rate at which mature colonies die. It takes them 3-8 years to mature, compared to the average lifetime of coral of 10 years. Colonies can grow very large and live for centuries.

Mountainous star coral are both male and female that release eggs and sperm into the water column once a year. They usually settle on the underside of surfaces, they prefer to settle on organisms found on the reef surfaces. In laboratory experiments most larvae found settled at least half an inch away from the red algae. Several species of zooxanthellae are associated with the coral, depending on the degree of light intensity reaching the part of the surface where they reside. The surface of the coral can be considered a small ecological community of many tiny organisms. The large structures produced by this species are of high ecological importance as they enhance the structural diversity, as well as integrity of reef systems and provide habitat for other species.

Once a highly abundant species, mountainous star coral has declined rapidly in the last few decades and is now absent in many of the shallow reef habitats it once dominated.

Decreased temperature can also stress mountainous star coral as the symbiotic algae associated with them are not very cold water tolerant. Unlike staghorn corals, the mountainous star corals collected through 1996 showed no evidence of change in calcification rates; however, ocean acidification has been documented to reduce their reproductive success.

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GULF OF MEXICO Fishery Management Council

NOAA CORAL REEF

Rough Cactus Coral *(Mycetophyllia ferox)*

Rough Cactus Coral occurs in the western Atlantic Ocean and throughout the wider Caribbean Sea, but it has not been reported in the Flower Garden Banks (Gulf of Mexico) or in Bermuda. They are typically shades of grey or brown, but may also be reddish or green. Rough cactus coral grows in water 15 to 270 feet deep, including shallow and mesophotic habitats that are greater than 300 feet. It forms a thin, encrusting plate and has valleys and walls of contrasting colors.

Rough cactus coral has both male and female reproductive organs but they do not release eggs into the water column; rather, they hold onto the fertilized embryos until those larvae are ready to settle onto something. Fertilized embryos are stored in the internal body cavity and spawned through the mouth. The embryos develop into a planktonic larvae and slowly started growing tentacles, plates and mouth parts before it settles in a substratum. Reproduction usually occurs once a year, between December and January.

Rough cactus coral is one of the least common coral species observed in monitoring studies, which makes it difficult to discern population trends. In Florida, this species has experienced significant population declines. Reported losses of rough cactus coral from monitoring stations in the Florida Keys and Dry Tortugas indicate a 63-80% population decline in these locations. As a result, it is presumed that genetic diversity for the species is low.

Rough cactus coral has declined due to disease in at least a portion of its range and has low recruitment, which limits its capacity for recovery from mortality events and increases vulnerability. Low recruitment makes it hard for this species to recover from mortality events.

Following a mass bleaching event in Florida in 2005, no bleached rough cactus coral colonies observed; only dead colonies were observed several days after the event.

Ocean acidification is predicted to accelerate most in deeper and cooler waters than those in which the species occurs. Its habitat includes shallow and mesophotic reefs which has moderate vulnerability to extinction over the foreseeable future because of the species occurs in numerous types of reef environments that are predicted, on local and regional scales, to experience highly variable thermal regimes and ocean chemistry at any given point in time.

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GULF OF MEXICO Fishery Management Council

NOAA CORAL REEF